D - Change the Speed

What if we want to change the speed our robot is following the line, without stopping it and reprogramming? Let's use variables and switches to do this.

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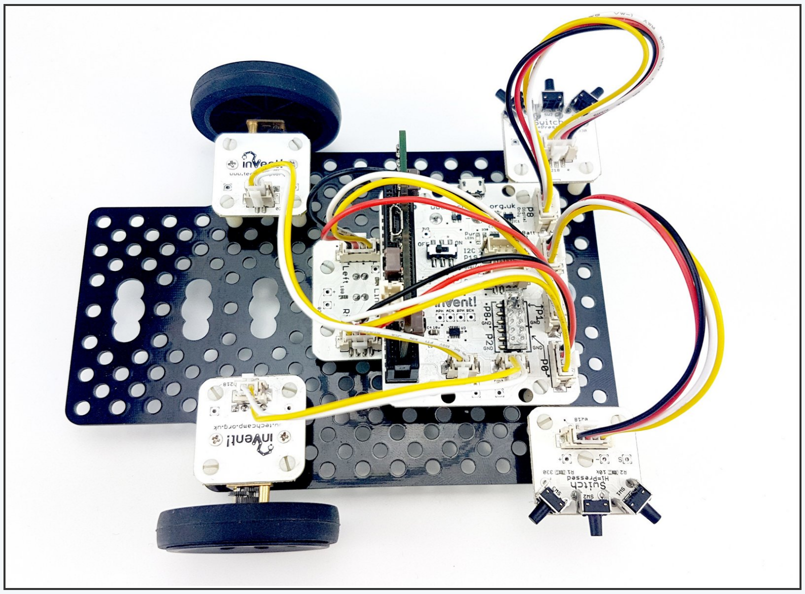
INTRODUCTION

What if we want to change the speed our robot is following the line, without stopping it and reprogramming? Let's use variables and switches to do this.

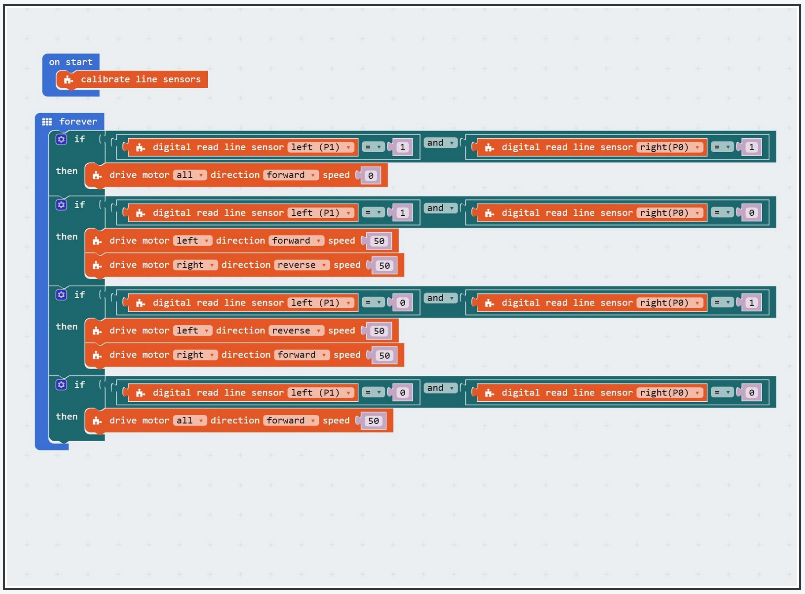
Step 1 Add the Switches

- We're going to need **two** switches - one to **increase** the speed, and one to **decrease** the speed.
- Add the **two switch modules** to your robot, and plug them into **P2** and **P8.**
- You can remove the Sparkles for now - setup the robot **just like the picture**.



Step 2 Two Sensor Follower Program

- **Load** your two sensor line follower program from the last lesson.
- **Remove** all the Sparkle blocks - they will make the program much longer and we don't have the Sparkles anymore.
- Your program should look like the **picture** - your speeds and waits might be **different**, depending on what works best for you.



```
on start
    calibrate line sensors

forever
    if digital read line sensor left (P1) = 1 and digital read line sensor right(P0) = 1
    then
        drive motor all direction forward speed 0
    if digital read line sensor left (P1) = 1 and digital read line sensor right(P0) = 0
    then
        drive motor left direction forward speed 50
        drive motor right direction reverse speed 50
    if digital read line sensor left (P1) = 0 and digital read line sensor right(P0) = 1
    then
        drive motor left direction reverse speed 50
        drive motor right direction forward speed 50
    if digital read line sensor left (P1) = 0 and digital read line sensor right(P0) = 0
    then
        drive motor all direction forward speed 50
```

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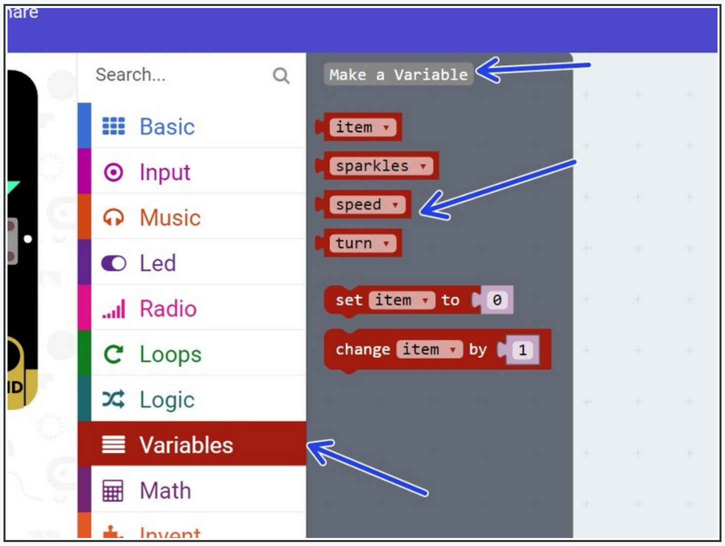
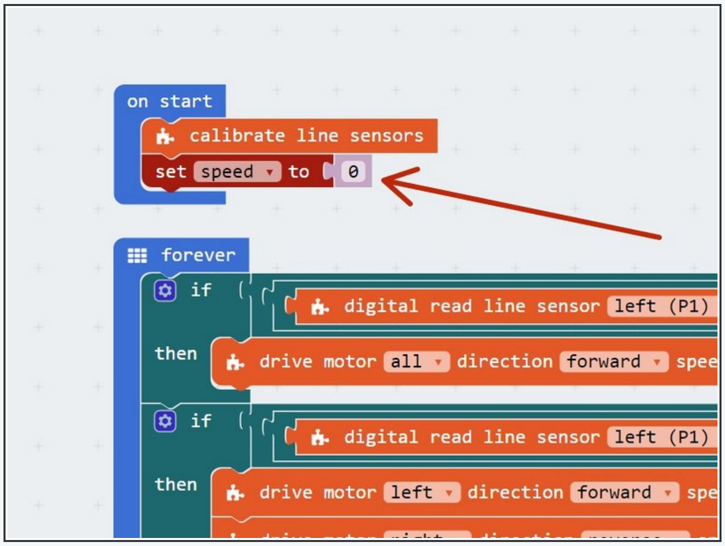
Step 3

Add a Variable




on start
calibrate line sensors
set speed to 0
forever
if
digital read line sensor left (P1)
then
drive motor all direction forward spee
if
digital read line sensor left (P1)
then
drive motor left direction forward spe

- Remember variables? Here's a quick **reminder** of what we can do with them:
  - **Call** them anything we like (variable **name**)
  - **Store** any number we like inside them (variable **contents**)
  - **Change** the contents at any time (add, subtract, multiply, divide and so on)
  - **Access** the contents at any time, so long as we know the **name** of the variable.
- **Add** a new variable called **speed**
- Right at the **start** of your program, **set speed to 0**

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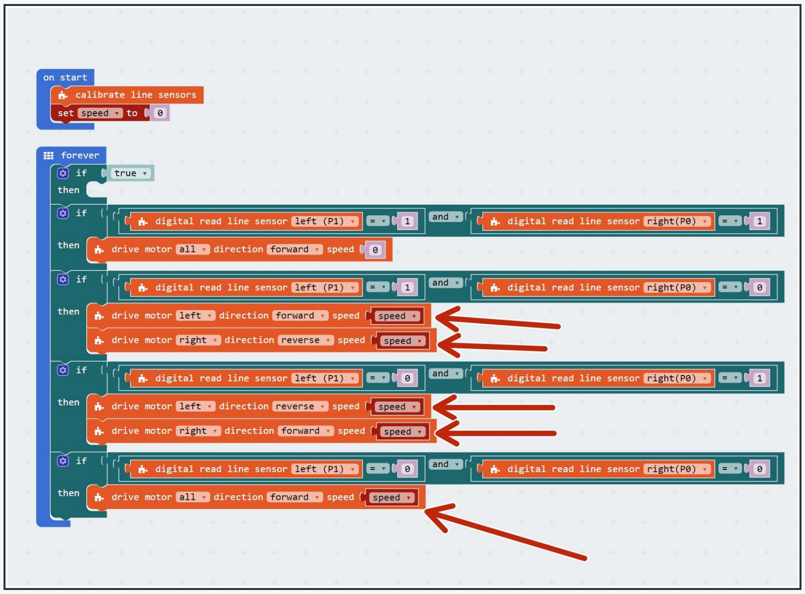
Step 4

Use the Variable

- Let's use the variable we have just created to **set the motor speeds!**
- **Replace** all the motor speeds in the motor blocks with the **speed variable.** We've done the first one for you!
- What would happen if we tested the program now? **Would the robot still follow the line?**
- **Test it out** and see if you're correct!



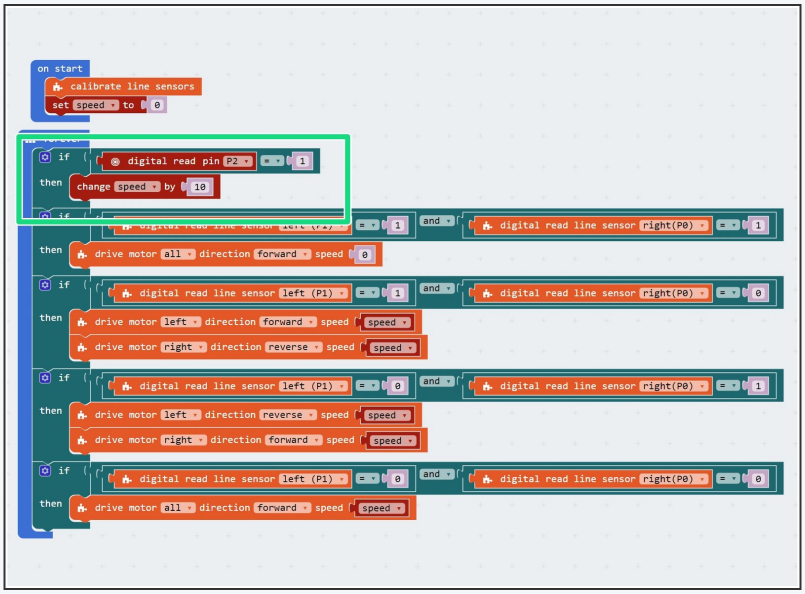
```
on start
    calibrate line sensors
    set speed to 0

forever
    if true then
    if digital read line sensor left (P1) = 1 and digital read line sensor right(P0) = 1
    then
        drive motor all direction forward speed 0
    if digital read line sensor left (P1) = 1 and digital read line sensor right(P0) = 0
    then
        drive motor left direction forward speed speed
        drive motor right direction reverse speed speed
    if digital read line sensor left (P1) = 0 and digital read line sensor right(P0) = 1
    then
        drive motor left direction reverse speed speed
        drive motor right direction forward speed speed
    if digital read line sensor left (P1) = 0 and digital read line sensor right(P0) = 0
    then
        drive motor all direction forward speed speed
```

Step 5

Increase the speed

- Let's use the **first switch** connected to **P2** to **increase** the speed.
- Add an **IF block** right at the top of the program to **check** the switch.
- If the switch is pressed, **increase speed by 10.**
- **Test** out the program - can you work out **what is wrong?**



```
on start
    calibrate line sensors
    set speed to 0

forever
    if digital read pin P2 = 1
    then
        change speed by 10
    if digital read line sensor left (P1) = 1 and digital read line sensor right(P0) = 1
    then
        drive motor all direction forward speed 0
    if digital read line sensor left (P1) = 1 and digital read line sensor right(P0) = 0
    then
        drive motor left direction forward speed speed
        drive motor right direction reverse speed speed
    if digital read line sensor left (P1) = 0 and digital read line sensor right(P0) = 1
    then
        drive motor left direction reverse speed speed
        drive motor right direction forward speed speed
    if digital read line sensor left (P1) = 0 and digital read line sensor right(P0) = 0
    then
        drive motor all direction forward speed speed
```

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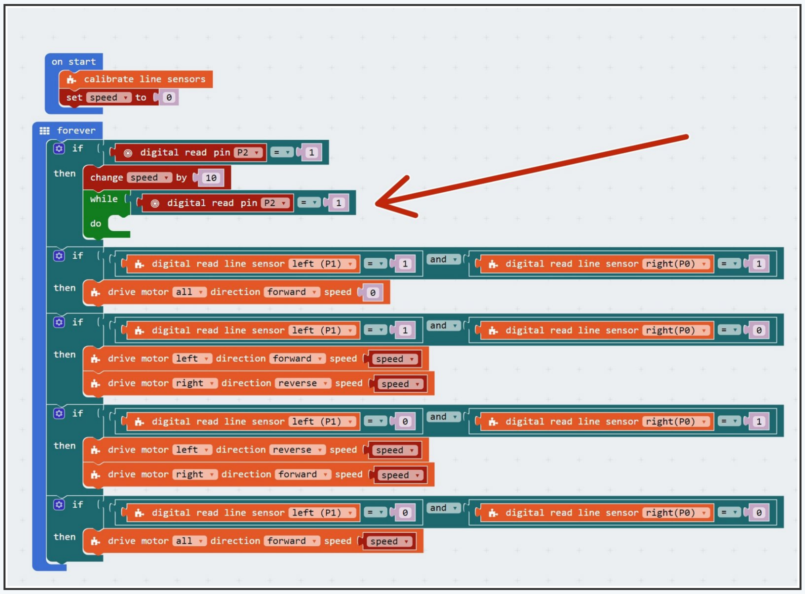
Step 6

Wait Until

- Remember last time we used a switch to change something? We had to add something else so it didn't change **too fast!**
- We want to **wait** until the switch is not pressed anymore, so we only increase the speed **once** each time the switch is pressed.
- Add a **while loop** after you increase speed by 10, that waits until we let go of the switch to fix this.
- **Test it out** - make sure it works properly now!



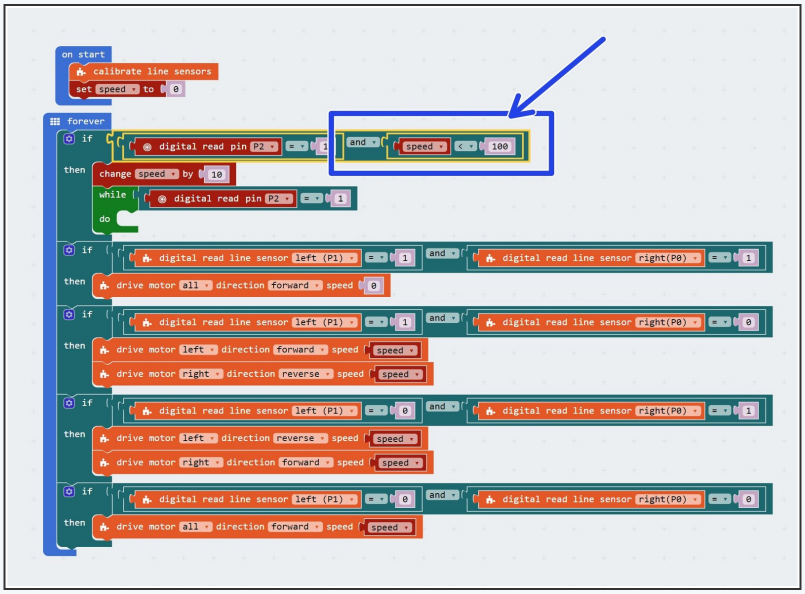
```
on start
    calibrate line sensors
    set speed to 0

forever
    if digital read pin P2 = 1
    then
        change speed by 10
        while digital read pin P2 = 1
        do
    if digital read line sensor left (P1) = 1 and digital read line sensor right(P0) = 1
    then
        drive motor all direction forward speed 0
    if digital read line sensor left (P1) = 1 and digital read line sensor right(P0) = 0
    then
        drive motor left direction forward speed speed
        drive motor right direction reverse speed speed
    if digital read line sensor left (P1) = 0 and digital read line sensor right(P0) = 1
    then
        drive motor left direction reverse speed speed
        drive motor right direction forward speed speed
    if digital read line sensor left (P1) = 0 and digital read line sensor right(P0) = 0
    then
        drive motor all direction forward speed speed
```

Step 7

Limit the Speed

- We don't want the value of **speed** to go **over 100** - we can't go any faster!
- To do this, let's edit the IF block that checks the switch.
- Change the condition so that it checks if the switch is pressed, **AND** speed is less than **(<)** 100.
- You can find the **less than** operator, < , in the **logic** menu.

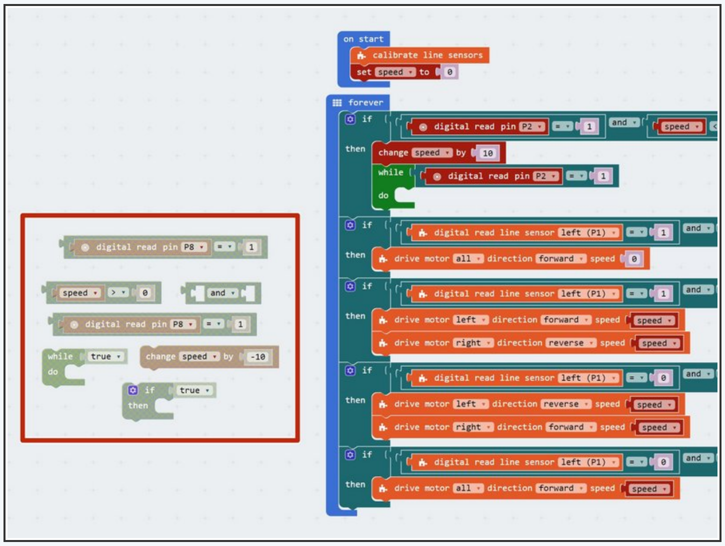


```
on start
    calibrate line sensors
    set speed to 0

forever
    if digital read pin P2 = 1 and speed < 100
    then
        change speed by 10
        while digital read pin P2 = 1
        do
    if digital read line sensor left (P1) = 1 and digital read line sensor right(P0) = 1
    then
        drive motor all direction forward speed 0
    if digital read line sensor left (P1) = 1 and digital read line sensor right(P0) = 0
    then
        drive motor left direction forward speed speed
        drive motor right direction reverse speed speed
    if digital read line sensor left (P1) = 0 and digital read line sensor right(P0) = 1
    then
        drive motor left direction reverse speed speed
        drive motor right direction forward speed speed
    if digital read line sensor left (P1) = 0 and digital read line sensor right(P0) = 0
    then
        drive motor all direction forward speed speed
```

Step 8

Decrease the Speed



```
digital read pin P8 = 1
speed > 0        and
digital read pin P8 = 1
while true       change speed by -10
do
                 if true
                 then

on start
  calibrate line sensors
  set speed to 0

forever
  if ( digital read pin P2 = 1 ) and ( speed <
  then
    change speed by 10
    while digital read pin P2 = 1
    do
  if ( digital read line sensor left (P1) = 1 ) and
  then
    drive motor all direction forward speed 0
  if ( digital read line sensor left (P1) = 1 ) and
  then
    drive motor left direction forward speed speed
    drive motor right direction reverse speed speed
  if ( digital read line sensor left (P1) = 0 ) and
  then
    drive motor left direction reverse speed speed
    drive motor right direction forward speed speed
  if ( digital read line sensor left (P1) = 0 ) and
  then
    drive motor all direction forward speed speed
```

- Now its **up to you!**
- Add some more blocks to check the **other switch** (P8), and **decrease** the speed by 10 each time it is pressed.
- This time, you will need to make sure that speed is only **decreased** if it is **more than 0.**
- We've given you all the blocks you need - just **put them in the right order!**

Step 9

One switch only!

- This is a **hard** extension challenge, so don't worry if you find it difficult!
- Can you change the code so only **one switch** is needed?
- The speed should **increase** with a **short** press, and **decrease** with a **long** press.

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Step 10

Speed change with sparkles

- If you're feeling really clever, **add the Sparkle code back in** once you've got rid of one switch!
- For super advanced coders only - can you change the **brightness** of the Sparkles depending on the **speed of the robot?** For example, at **maximum speed (100)** they should be as **bright as possible**, and at **0** speed they should be **off**.

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